

Engineering Management
Field Project

**Challenges for Growing Engineering Services within a Large
Construction Company**

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Fall Semester 2008

An EMGT Field Project report submitted to the Engineering Management Program and the Faculty of the Graduate School of The University of Kansas in partial fulfillment of the requirements for the degree of Master of Science.

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1. Acknowledgments

I would like to thank my wife Diana – attending classes and doing homework for this master degree program took so much of my time away from her and my son Ryan who was born during my second semester into the EMGT program.

To my father- and mother-in-law, Steve and Peggy — they have spent so much time helping correct my homework papers, including this field project. My writing skills in English have improved thanks to them. Moreover, their encouragement, understanding of the sacrifice of going thru a master degree program, and love is always a source of energy for me. Thanks Mumma and Buppa.

PKS Power Engineers that provided me with the financial backing to complete this master's degree program.

To Linda Miller for guiding me thru the sales, marketing process and completing this field project.

2. Executive Summary

PKS is a construction company with annual revenues of 6 billion dollars. Some engineering services already exist in the company, yet the author believes that there is capacity for growth in engineering services; specifically in the discipline of civil engineering.

This paper studies the challenges for growing the engineering services within PKS only with the intention of identifying potential growth opportunities for professional designers in the branch of civil engineering. The benefits of growing in-house engineering services are:

- To have a larger pool of design professionals to accomplish not only the design but also the construction of large projects.
- To increase revenue by keeping work in-house.
- To make the design-build process more efficient.

This paper is written to provide guidance on how to overcome some of the challenges for growing the services provided by an existing small engineering unit within a large construction firm. The two most important challenges addressed in this document are:

- How to sell engineering services within the company.
- Have a better understanding of the legal implications of combining the construction and engineering services.

The process of getting more work would likely take months or years; therefore, the goal of this paper is limited only to planning the initial stage of the process.

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5. Introduction

If I had a large engineering firm with a good reputation and proven track record of successful design projects then I could easily partner with big construction firms and create joint ventures that could design and build the biggest, most challenging projects in our nation.

However, if the only resources available are 10 design professionals and 10 technicians working in that big construction firm, how can I sell the idea of growing the group to potentially take on bigger and bigger projects? What would be the implications if this small group started taking on more work from the construction company not knowing the legal implications of doing so? What opportunities are being missed by not having a larger engineering capability in-house? Maybe the risk is too big and it would be better to stick to what we know. Perhaps the most important question is "how would the company benefit by hiring more design professionals?"

Those are the questions I am attempting to answer in this paper. Specifically, I would like to focus on how to address two of the main challenges for growing the engineering services. These challenges are: 1) to choose a selling approach for convincing management to increase the engineering services and 2) to learn more about the legal implications of combining engineering and construction services. Addressing these two topics in this paper will serve as a solid starting point for the journey ahead.

The motivation for growing the engineering services is not only to increase profits for the small group that is trying to grow, but also, on a larger scale, to address the

problem of retaining valuable people by creating interesting career advancement opportunities, and to better respond to a growing market that demands projects built fast and built right. People with this set of skills are nothing new, actually, the concept of master builder as known in the nineteenth century is pretty close to the concept proposed for career development for engineers in this paper

I will refer to my company as PKS. PKS is a multi-billion-dollar construction company with several subsidiaries called “districts.” For the most part, districts within PKS work independently, with each having contact mainly with headquarters and little contact with each other.

PKS already has some engineering services; two districts are solely dedicated to providing engineering services. KEC is the designated primary district for engineering support needed during construction, and for providing second checks for estimate preparation as engineering support. My district, KPE, exists to engineer power plants. Within KPE the traditional disciplines involved in designing a power plant are present: civil, structural, mechanical, electrical, and instrument & controls.

KPE partners with other “builders” within the company to work on design-build for power plants. My unit, the civil department, is responsible for engineering site preparation for power plants, yet there are only so many power plants to go around. This limits the growth my group can have within the company, perhaps to a maximum of 25 people. However, most of the work done by PKS is civil work, which consists of highways, airports, bridges, etc.

The KPE civil department capabilities are not in conflict with those in the KEC district. Instead, they complement each other, and therefore, the author believes that there is room for growth within the company.

In addition to increasing billable hours and generating more profit for KPE, having a better integration within the districts would allow the engineers to have more options to choose from in advancing their career development, while at the same time, districts could have a large, well-trained civil engineering force that could work either on the design of the project or in the construction.

We then need to find a way to sell the idea (the value proposition) to company management, and to address one of the main objections, which involves the legal issues that arise from having engineering and construction in the same company. To achieve the goal of having a good sales approach, the concept of the value proposition is first analyzed in section 6.1. Then, in order to have a better knowledge about the legal implications, section 6.3, titled "The Legal Challenges," has been included.

The current PKS situation is analyzed in section 7 by first examining the company overall and then by focusing on the individual districts. Some information could not be included in this paper in order to maintain the appropriate level of confidentiality. However, the information presented is sufficient to do a first pass on how to move forward. Finally, in section 7.5, a brief analysis of potential buyer districts is developed.

After understanding the current situation of the company (section 7), we will proceed to formulate a value proposition that will be the basis for the sales approach (section 8.5). The value proposition provided here is only a template, or a first draft, for the final value proposition, since the necessary data from the customers (their needs) is

not well-established at this point. We then discuss the legal aspects or objections that could potentially affect the sales process (Section 8.6). To conclude section 8 we will discuss the negative consequences of not being successful in growing the civil department.

Finally, I will present conclusions about the findings of the research; on how to sell the need for growing engineering services by using a value proposition, and its applicability during the early stages of the process when clients' needs are not well established yet. Comments about how to handle legal objections are also included in the conclusion section of this paper.

6. Literature Review

6.1 The Concept of Value Proposition

The term “value proposition” was coined by a former McKinsey & Company consultant named Michael Lanning in a 1984 white paper. Lanning said that the business was a value delivery system and that this system could be articulated in a “value proposition”. Fourteen years later in his book *Delivering Profitable Value* (New York, Perseus Book, 1998), Lanning defined a value proposition as:

The combination of resulting experiences, including price, which an organization delivers to a group of intended customers in some time frame, in return for those customers buying/using and otherwise doing what the organization wants rather than taking some competing alternative.

The basic concept is about shifting a company mentally from an internal-driven entity by focusing instead on the needs of the client, and establishing a set of values that will appeal to customer needs.

Properly understood, business is very much about the exploration and improvement of customers’ real-life experiences. The traditional concepts of “needs, requirements and benefits” share important common ground with resulting experiences. However, the differences are considerable, as the conventional concepts focus too much on what the business does or on superficial, vague ideas of benefits or needs. Managers

must learn to deeply understand and decisively act on specific experiences customers would most value.

Selecting a value proposition that will generate growth means making a disciplined, precise decision as to what the business will ask customers to do (including what products and services they will be asked to buy and use), and what specific experiences the business will cause the customer to have as a result. (Thull, 2006)

A complete value proposition is an explicit disciplined strategic choice and covers:

- I. Who are the target entities for this value proposition (VP)?
- II. What is this value proposition's time horizon?
- III. What do we want these target entities to do?
- IV. What competing alternative(s) do these entities have?
- V. What resulting experiences (including price) will they derive, vs. these alternative(s), if they do as we propose?

Statements called "Value Propositions" are common, but are often unactionable, superficial, internally-driven or customer-compelled.

The following table provides guidance on what complete value propositions are.

Actionable choices are:	Actionable choices are not:
Measurable, specific proposed results	Vague, indecisive platitudes and unactionable lists of general categories
What will happen for the entity	Internally-driven statements of what we will do
Experiences that we believe the entity would value	Customer-compelled regurgitations of what customers say they want/require
What we will and will not deliver - includes tradeoffs	Promises of the moon

Table 1 Complete value proposition characteristics

Lanning applies the concept of value proposition on his Delivering Profitable Value concept, where he emphasizes the need for a more comprehensive system to deliver the value proposition. He also warns against the misuse of the value proposition, which may become a commodity when it's written too vaguely. The basic concept of the Delivering Profitable Value system is shown in Figure 1-The concept of Value Delivery System.

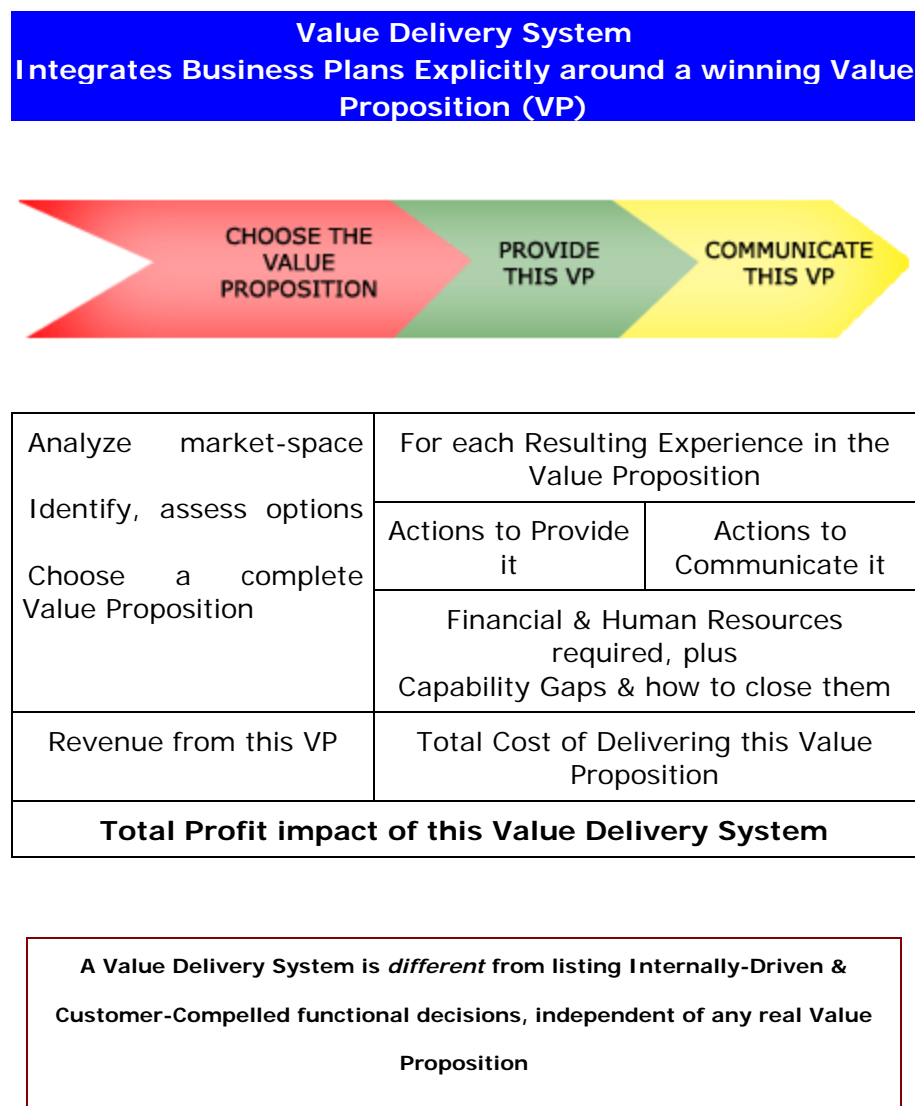


Figure 1-The concept of Value Delivery System.

The value proposition was first introduced in the mid 1980's when the idea of selling customers value was new and set a company apart. Today, the critical importance of selling value is blindingly obvious to everyone in the world of complex sales. Sales professionals fully realize the customer demands for value and, thus, their presentations and proposals are focused on value. The ubiquity of the concept and the creation of value, along with the environment in which every customer is demanding value and every seller is promising to deliver it, have created a major communication challenge. It is a substantive communication challenge that most sales professionals are failing to meet.

The roots of this problem are anchored in the widespread misunderstanding and misuse of value propositions. Companies create these propositions to articulate the value they plan to offer customers. (Thull, 2006, p. 35) Major mistakes in offering a value proposition include (Sant, 2004, p. 108):

1. Trying to be everything to everybody
2. Making loud claims: “best of breed,” “world class,” “industry leader”
3. Offerings a proposal that spends more time attacking a competitor than it does responding to the client's needs.
4. Writing a factual or technical description, explaining features of your solution without also indicating their value for the client.
5. Producing a “cost paranoia proposal”, one that focuses exclusively on trying to prove that this solution is the cheapest, no matter what the numbers may look like.

The reality is that if you cannot position yourself and your company as a source of value, prospects will not want to talk to you. If you can't create and clarify value; your customers will not take any action and are not going to buy. The issue of value is inescapable. Every conversation with a customer should be a conversation about value,

and every solution provider must remain vitally concerned with value. Customers want to know how your offerings are going to add value to their business and help their careers, and how it's going to reduce their company's cost or generate additional revenues. They also want to be assured that your solution will be delivered as promised. (Thull, 2006, p. 32)

In Section 8.5, a value proposition will be developed for PKS based on the concepts and information presented in the beginning of this chapter

6.2 Communicating the Value Proposition

After creating the value proposition, it will be necessary to present the information first to higher KPE management levels for their support and for resources to undertake the tasks. After management from KPE supports the initiative by contacting the rest of the districts, a series of phone calls and trips to each of the districts should follow. Thus, it is important to analyze the best way to approach each of the buyers. Since the author's background is in engineering and not in sales, it has been important to study several books with the purpose of gaining knowledge and confidence before presenting the value proposition. The first concept that I found useful was that the initial contact with a prospective customer is the most critical, and no doubt, the least forgiving stage of the sale. At this stage, the slightest lack of due diligence in terms of preparation can easily result in a full-blown sales engagement that is doomed to fail from the start. (Thull, 2006, p. 83)

The effectiveness and quality of the initial contact with the customer depends on the information that the salesperson has developed in the qualification process. (Thull, 2006, p. 88) With this in mind, Section 7 has been included in this paper in order to provide background information to qualify each of the potential buyers. For those districts where information is readily available from the corporate headquarters or company's intranet, a "first pass" analysis will be developed.

The initial contact with other districts would likely be via telephone. The following sales call template, developed in EMGT's 800 Sales, could be used.

1. Prospect Information		
A. District Name:	Type of Business:	
Key-Person Information		
B. Prospect's Name (Key Decision Maker):	Job Title:	
C. Other people involved in the purchase decision:		
Name(s)/Job Title	Department	Role In Purchase Decision
2. Customer Value Proposition: A brief statement of how you will add value to the prospect's business by meeting a need or providing an opportunity. Include a brief description of the product or service:		
A. Product/Service that delivers value:		
B. Value Proposition Statement:		
3. Sales Call Objective (must require customer action):		
Inform customer of product and get second meeting.		

Figure 2 Initial Sales call template

After initiating the process of communicating with a district the following template, also obtained from EMGT 800 (Ingram), can be used to obtain more information from the district representative.

Amount of and Specificity of Information Desired				
	Explore and Dig For Details	Gain Confirmation & Discover Attitudes/Opinions	Change Topics or Direct Attention	Follow-Up Previously Elicited Statements
Discussion and Interpretation	Open-end Questions Designed to be Probing in Nature	Open-end Questions Designed to be Evaluative in Nature	Open-end Questions Designed to be Tactical in Nature	Open-end Questions Designed to be Reactive in Nature
Confirmation and Agreement	Closed-end Questions Designed to be Probing in Nature	Closed-end Questions Designed to be Evaluative in Nature	Closed-end Questions Designed to be Tactical in Nature	Closed-end Questions Designed to be Reactive in Nature
Choices from Alternatives	Dichotomous or Multiple-choice Questions Designed to be Probing in Nature	Dichotomous or Multiple-choice Questions Designed to be Evaluative in Nature	Dichotomous or Multiple-choice Questions Designed to be Tactical in Nature	Dichotomous or Multiple-choice Questions Designed to be Reactive in Nature

Figure 3 Guidelines for obtaining information

One of the commonly overlooked elements in a career in business-to-business sales is the fact that sales professionals often have to sell the same deals within their own companies that they sell to their customers. More often than not, the internal sale is even more difficult than the external sale. When sales professionals don't approach their internal customers with the same process and discipline, their deal and credibility often fall apart because they did not equip their colleagues and superiors with what is needed to make high-quality business decisions. (Thull, 2006, p. xxiv)

A viable sales opportunity can deliver value, not only to your customer, but also to you and your company. It has the potential to solve substantiated customer problems, create customer value that is tangible, achievable, and measurable, and produce a profit.

Successful professionals achieve credibility by guiding their customers through value-driven business decisions. They win customers' loyalty and trust through respectful, honest, and diagnostic-based communication. (Thull, 2006, p. 8)

6.3 The Legal Challenge

One of the important challenges to overcome when trying to grow engineering services within a large construction company is the perception that, by doing engineering services too, the construction company causes the potential for liability to be bigger and different from what PKS is used to accepting. This section deals with some legal concepts likely to emerge while trying to sell the growth of engineering services.

6.3.1 Liabilities

PKS is mainly a construction company. The concept of avoiding risk is well ingrained in the company's culture. Most of the district understands that PKS's engineering capability is limited to that of support during construction, such as to evaluate the construction sequence used for a particular bridge, or to design a temporary structure such a coffer dam to allow construction in a confined area.

The concept of doing in-house engineering is relatively new compared to the company's long experience in construction. Therefore, it would be important to clearly define the type of involvement that the group of civil engineers is willing to have with other districts and the potential legal ramifications of doing so. The goal of this research is that when performing sales calls on other districts, the seller needs to display a sufficient understanding of the legal aspects of doing construction and engineering in the same firm. Moreover, the seller must understand the mechanisms that can be utilized to shield the construction partner from potential engineering legal liability.

Performing engineering work within PKS could be done in three different manners, based on the previously described relationships between KPE and KEC and the other districts on tasks that fall outside the civil engineering discipline:

Option 1: the engineering work is done solely as a construction support task with no “issue for construction” or stamped drawings by a professional engineer.

Option 2: the engineering work is done as a separate contract, the same as PKS would arrange with any engineering firm outside the company.

Option 3: other PKS districts and the KPE civil department enter into a partnership agreement, where both share risk, responsibilities, and profits.

Considering the legal risk of using the first option, it is possible that setting up this type of relationship may establish a case of what is called “agency” between the contractor (PKS) and the engineer. Agency is created by express or implied contract or, less frequently, by operation of law, estoppels, or ratification.

Agency can be described as acting through another. One party, called the principal, authorizes another, called the agent, to represent the former in certain business dealings with outsiders. Essentially, agency is a consensual relationship where the agent has the power to bind the principal and the principal has the right to control the agent. (Bockrath, 1995, p. 245)

In option 2, the relationship with other PKS districts is more likely to be interpreted as one of an independent contractor rather than agent. A true independent contractor is neither an employee nor an agent. The independent contractor is hired to do a given job in return for a set charge. In the scenario of option 2 then, the other PKS district would be the hiring party, whereas the KPE civil department would be the

independent contractor. In this case, the party employing or hiring the independent contractor has no right to control performance details, and therefore becomes not liable to outsiders for harm stemming from negligence of the contractor or his employees.

The party hiring could, however, sometimes be held liable by action from the independent contractor in cases where, for example, the task the contractor is asked to handle is hazardous in nature. Then the hiring party cannot divest himself from potential tort responsibility. Furthermore, even where the activity involved is not inherently dangerous, if the hiring party contracts with someone whom he knows, or should know, to be incompetent, he may be held liable for injury sustained by third parties as a consequence of the contractor's faulty execution of the work. (Bockrath, 1995, p. 246)

The case for agency is created as a result of the way the work is contracted. It is important to understand that every "agent" has certain obligations toward his principal or hiring party. For example, the agent must display the utmost loyalty and good faith, must obey instructions, and must attempt not to exceed his authority. The agent is expected to utilize reasonable care and skill in fulfilling his duties, and he is obliged to account to his principal whenever the latter requests it, and when the agency is terminated. All profits arising from the undertaking are deemed to belong to the principal, unless otherwise agreed between parties.

It is a fundamental proposition in law that a principal is liable on all contracts made by his agent while that individual is acting within the scope of his actual or apparent authority. The principal has certain basic responsibilities toward his agent, perhaps the most significant of which is the duty to give reasonable compensation for services rendered.

In the field of torts, the principal is liable for acts of negligence committed by the agent while the latter was operating within the scope of his authority and in furtherance of the principal's business. (Bockrath, 1995, p. 249)

Finally, if a contractual setting is chosen to resemble the previously described Option 3, most likely, the parties involved would use a contract of partnership, therefore creating agency. In this partnership arrangement each of the partners doubles as a principal and agent and acts of each other are binding on all.

The Uniform Partnership Act (Section 6) defines the ordinary partnership as “an association of two or more persons to carry on as co-owners a business for profit.” Partnership arrangements, which normally are geared for a considerable period of time, feature community of interest in profits, losses and capital employed, as well as joint control of the operation. Rights typically governed by the partnership agreement are:

1. Right to share in the management and control of the firm's operations
2. Right to share in profits
3. Right of co-ownership of specific partnership property
4. Power to act as agent for the partnership
5. Right of contribution from his association in case he personally makes payments on partnership accounts.

Unless a statute states otherwise, it is possible to form a partnership by oral agreement. However, written articles for partnership, signed by the parties and setting forth the terms and conditions of the agreement provide the customary method of formalizing the agreement.

In a partnership relation, every partner is an agent of the partnership for the purpose of its business, and the act of every partner, including the execution in the partnership name of any instrument, for apparently carrying on in the usual way of business of the partnership of which he is a member binds the partnership unless the partner so acting has in fact no authority to act for the partnership in the particular matter, and the person with whom he is dealing has knowledge of the fact that he has no such authority. (Act, Uniform Partnership)

With the knowledge of the possible options on how to set up a working relationship with other districts, then the legal questions or objections would likely turn on particular aspects of the liability differences between the contractor and the engineer. To understand this better, let's examine some of the basic legal responsibilities for each party.

Once the appropriate business relationship is selected based on the scope and nature of work, the attention on the legal aspects would likely have to address the detail work. Questions about the level of involvement an engineer should have in creating specifications are always a topic of discussion when the work is done within the same company. For example, in a joint venture, if the engineer restricts too much how the work can be constructed, he may cause a cost increase. On the other hand, if specifications are too vague, then the risk of constructing the work with not enough quality may occur.

The next section briefly explores some of the basic legal concepts necessary to discuss the issue of the limits of the engineer's role and the level of care needed to produce drawings and specifications.

6.3.2 Drawings and Specifications

The question often arises as to what level should the engineer be involved in describing the quality of the workmanship that will be required of the contractor who is to build a project. Workmanship is intended to denote the contractor's operations in the shop or field rather than the material used by him in the performance of the contract.

An independent contractor must be free to control how the work shall be performed. When the contractor signs the contract, it becomes his duty to perform in accordance therewith, to follow carefully the plans and specifications, and to furnish proper materials and workmanship as required by them. Broadly speaking, There is no negligence from the builder who follows defective or inadequate plans and specification furnished by the owner or engineer. In the same manner, should the contract documents specify exactly how the work is to be handled, then the engineer has largely assumed responsibility for securing the desired results. This is something about which the owner and his representatives must be extremely careful. (Bockrath, 1995, p. 191)

While the rules of law are perhaps not entirely clear in this area, generally a builder needs only to comply with the detailed specifications. Having done so, he is not answerable for an imperfect result which is not attributable to improper workmanship, negligence, or the use by him of defective materials. On the other hand, if plans and specifications are lacking in detail, or were prepared so as to leave open the methods of construction to be employed, or the kind or quality of materials to be used, then the contractor, because he has freedom of choice, must select his method and materials and exercise his discretion to produce a result which is substantially satisfactory.

There may be circumstances that make it necessary to specify in detail just what is to be done and how it is to be accomplished, thereby deliberately assuming responsibility. This is generally done in instances where the contractor will not be able to determine the desired or proper course himself. (Bockrath, 1995, p. 192)

6.3.3 Lessons from Design-Build

Having the engineer work closely with the contractor is a concept that has existed for a long time. This situation is very common on design-build projects. This section explores the basic concepts of design-build, with the purpose of clarifying and emphasizing when this setting would be desirable as well as its legal consequences.

Under the traditional method of construction contracting, the owner hires a design professional (architect or engineer) under one contract, and then hires a general contractor under a separate contract. The owner is literally caught in between these two entities. If there is a construction problem, often the designer blames the contractor and vice versa, with a lot of unproductive time spent in finger-pointing rather than problem-solving (Quatman II, 2001, p. 3). The next figure depicts the traditional method of construction contracting.

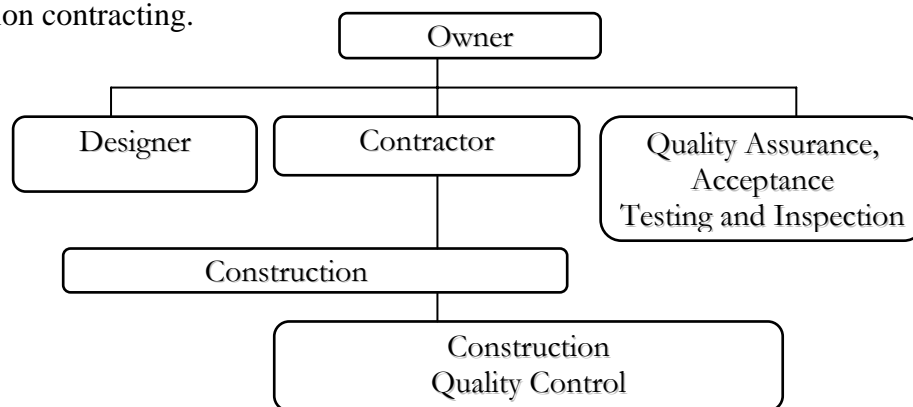


Figure 4-Traditional construction contracting relationships

Design-build, in contrast, is the type of construction contracting where one entity provides the owner with both the design services and the construction services needed to meet the owner program. The owner gets both the design and construction under one contract from a single source rather than the traditional method of separate contracts with the architect/engineer and with the general contractor (Quatman II, 2001, p. 4). See next figure.

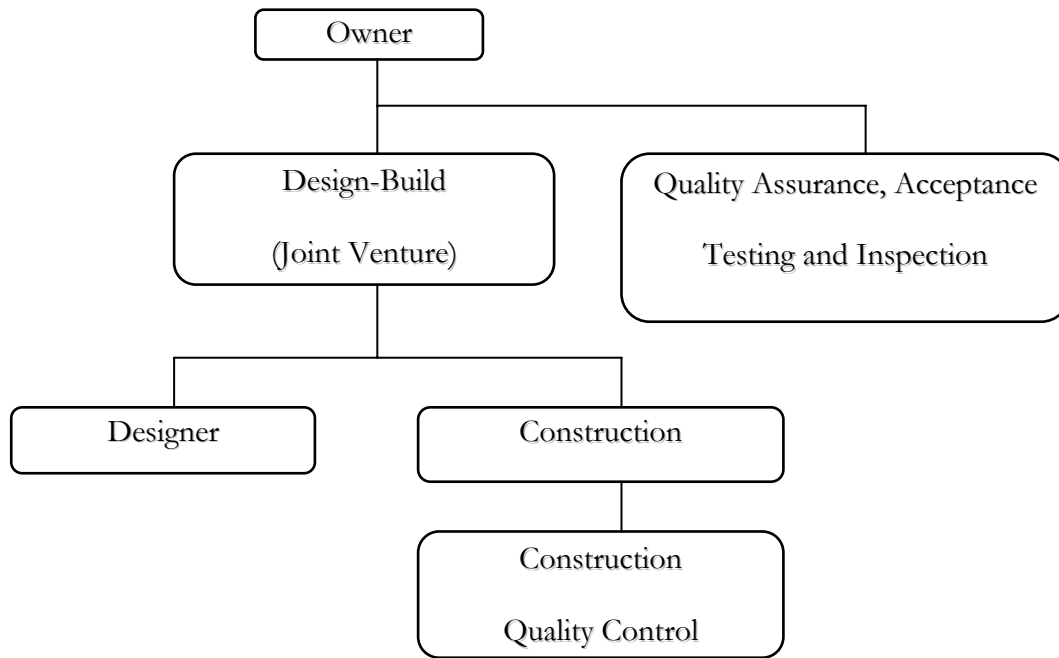


Figure 5- Engineer-Procure-Construct
(Design-Build)

The following are the most commonly cited benefits of design-build contracting: (Claitt)

- It gives the owner a single point of responsibility in cost control, quality and schedule.
- It provides for Designer-Contractor teamwork, sharing the concern for safety, designing to the contractor's means and methods, combining the analysis of sequencing of constructability, encouraging quality planning by integrating the

design-build team into all aspects of the project, and using value engineering early and effectively.

- It has the potential for time savings because it overlaps the design and construction processes, allows earlier start of physical work by eliminating bidding period, eliminates re-design time, and allows for early material procurement for long-lead items.
- It has the potential for cost savings, since it develops alternative concepts, materials and methods, reduces the owner's administration burden, insulates the owner from cost inflation, and provides earlier utilization of completed facilities.
- Guarantees occur in project cost: the early knowledge of firm cost aids financing, reducing exposure to escalation; it avoids the "too expensive to build" scenario, eliminates design-driven change orders, and transfers risk appropriately; the delivery date is set up front.

	Traditional Method	Design-Build
Scope	Prescriptive	Outcome Focused
Budget	Greater Potential for overruns	Fixed Lump Sum
Delivery Time	Normal Process	Expedited (up to 45% Faster)
Responsibility	Potential Finger Pointing	Single Point
Risk	Owner/Designer Shared	Owner/Designer/Contractor Shared
Innovation	Limited by Standards	Design to Contractor's Strengths
Partnering	Efforts during Construction	Fluid throughout Project
Warranty	Standard	Potential for Multi-Year
Change Orders	Probable	Less Likely
Contractors	Many Possible	Limited to Larger Firms
Quality	Enforced in Field	Planned into Project during Design
Value	After Bids	During Design

Table 2 Differences between traditional and design-build method

6.3.4 Risks of Design-Build

Risk is often defined as “possibility of loss or injury; a dangerous element or factor.” For a given project, risk is defined as an unexpected event or circumstance that has a chance of occurring and that may prevent a project from meeting its schedule and cost estimate.

The risk of not completing the project on-time and on-schedule will depend largely on the compatibility of the design-build team. For this reason, team members must carefully examine their respective cultures to ensure “a good fit.” A competent engineer teamed with a competent contractor does not necessarily provide for a successful team. Problems arise when the Contractor expects immediate answers from the engineering partner. Thoughtful answers cannot be given when no time for consideration is allowed. It is important to examine and compare factors such as experience, conceptual estimating abilities, mutual respect, corporate culture, and willingness of all partners to “listen” for a good teaming relationship. (Hackler, 2003)

6.3.5 Risk Management in Design-Build

Risks need to be identified in the Request for Proposal (RFP) document; these risks should be properly addressed in the Contract. Risks should be allocated with consideration given to the party who is in the best position to manage and control a given risk or the impact of a given risk.

Risk allocation will vary according to the type of project and location; however, the following factors should be considered:

Financial Risk: Just as in the “Traditional” delivery method, it is important to establish the owner’s financial position. Clients working as “developers” may commonly lack financial backing and may be first looking for a designer-contractor fee in order to take it to a financial institution. Investigate who is the contracting party and if the project is financed by the customer or by a banking institution. This will provide better assurance about the feasibility of the project.

Commercial Risk: It is necessary to know how payments, liquidated damages, performance bond, applicable law, warranty, indemnification and insurance will be covered in the contract; for this task a support group that reviews legal, financial, insurance, and tax terms in the contract needs to be established.

Schedule Risk: The contract needs to specify important milestones such as Mechanical Completion, Substantial Completion, Provisional Acceptance, Commercial Operation Date, Utility Interface (Natural Gas, Water), Owner Supplied Equipment Delivery, and Permit Approvals.

Performance Risk: The design-build contract needs to be clear about the expected general system output and efficiency.

Reliable Information Risk: It is always advisable for the owner to take steps to reduce the risk of unforeseen conditions, such as by obtaining geotechnical surveys, and to allow the design-build team to rely on the survey results to a certain extent.

Typically the design-build team will be allowed a price increase and/or time extension if the actual site conditions differ from those reasonably assumed, or the

design-build team will be given relief only if they can establish that the information provided was incorrect, leading to incorrect conclusions regarding the actual conditions. In some cases the contractor is entitled to a price increase only for major problems.

Another way of dealing with uncertainty over information provided is to have the design-build team have a contingency pool for compensation. Following exhaustion of that pool of funds, they cannot receive additional relief.

Remediation of hazardous materials is another issue of major concern. Where the risk is low, owners usually allow a price increase based on time and materials records, or unit prices included in the proposal.

Solutions for higher risk projects include extensive specifications regarding management of remediation work, including the obligation to show that the work was necessary and could not have been avoided or mitigated

In a Design-build delivery method, the design-build team is exposed to a greater degree of liability for project-related defects than either team would incur if the project were designed and constructed by independent teams.

In the traditional delivery method, the designer is liable principally when the design and/or the designer's professional performance deviates from professional standards. Similarly, the contractor is liable when its performance deviates from project plans and specifications, or from the standards of good workmanship.

In addition, the design-build team is liable for defective project-related conditions irrespective of whether the project was designed in accordance with industry standards or whether the work was performed in accordance with the plans and specifications. The

liability is imposed by extending theories of express warranty as measured by the design-build team's contractual undertaking.

In the traditional process, the designer's undertaking does not express or imply such a warranty. Traditional theory accepts that designers, like other professionals, perform an inexact science. They are called upon to exercise professional judgment in matters which are often beyond their control or influence. This requires an assessment of numerous factors which are incapable of precise analysis. Unless the designer "guarantees" the design, the owner/developer bears the risk of the unforeseen or the uncontrollable.

The design-build approach requires that the finished project comply with the owner/developer's expectations of performance. The warranty obligation is expressed by the design-build team's acceptance of a performance specification as the measure of the contractual undertaking. The risk of the unknown contractually shifts from the owner/developer to the design-build team.

This assumption of risk has been treated as an expansion of the Contractor's warranty obligation and not an expansion of the professional undertaking. Rather than merely warranting workmanlike performance, the design-build team warrants the performance of the project as a product. The project must be fit for the performance objective.

6.3.6 Examples from Legal Cases

The warranty basis of the design-build team's liability is discussed in *Kishwaukee Community Health Services Center v. Hospital Building and Equipment Company, et. al.*,

638 F.Supp 1492 (E.D.Ill., 1986). The court observed that design-build is a package situation which relates the professionals' service to a product. Since the plaintiff developer's expectations were for a final product, its remedies should be product-oriented and thus lie in the contract/warranty area.

In considering whether to impose design-build liability, the courts look beyond the labels ascribed by the parties to the contract, and evaluate the characteristics of the project specifications. The test is whether the project specifications are performance or design specifications. See *S&D Mechanical Contractors, Inc. v. Enting Water Conditioning Systems, Inc.*, 71 Ohio App. 3d 228, 593 N.E.2d 354 (Ohio 1991).

The distinction between a design and a performance specification is further described in *Dillingham Construction N.A., Inc. v. United States*, 33 Fed.Cl. 495, 500 (1995), as follows:

In general, specifications are divided into two categories: design specifications, and performance specifications. The difference between design and performance specifications is well settled. Design specifications “describe in precise detail the materials to be employed and the manner in which the work is to be performed” Blake Constr. Co. v. United States, 987 F.2d 743, 745 (Fed. Cir. 1993) (quoting J.L. Simmons Co. v. United States, 412 F.2d 1360, 1362, 188 Ct.Cl.684(1969). They afford no discretion to the contractor, which is “required to follow them as one would a road map.” [cite omitted]. Performance specifications, however, “set forth an objective or standard to be achieved, and the successful bidder is expected to exercise his ingenuity in achieving that objective or standard of

performance, selecting the means and assuming a corresponding responsibility for that selection” [cite omitted].

Design specifications describe in precise detail the materials to be employed and the manner in which the work is to be performed, affording no discretion. Performance specifications set forth an objective. Successful bidders are expected to exercise ingenuity in achieving the objective.

6.3.7 Economic Realities for the Design Professional

The economic consequences of the design-build process for the design professional are two-fold. First, the design professional is removed from the role of a professional advisor to the owner, thereby decreasing the market for his or her services. Second, the professional services performed for the design-build team are expanded, thereby increasing the exposure for negligence.

At the same time, the process presents an economic opportunity for design professionals to expand the market for their services by becoming design-build teams. (In addition to the expanded market of construction related activities, the design-build team, as part of the value engineering services delivered, becomes intimately familiar with the internal business functions of its client.) Successful completion of a project creates a lifetime client requiring services relating to facility upgrades and life-cycle costs.

The designer's professionalism is founded upon the ethical requirement of placing the client's and society's interests in front of the economic interest of the professional.

The diminishing role as professional advisor is the result of the professionals' failure to fulfill that role to the satisfaction of the industry. This failure is built into the fabric of the professional relationship, because the commonly accepted fee arrangement compensates the design professional based upon a percentage of the construction cost. This fee arrangement is in direct conflict with the client's need for value engineering.

Clients today place as great an emphasis on the functional utility of a project as they do on the aesthetic image projected by the completed facility. Where cost and time are more important than aesthetic quality, the professional's aesthetic talent is less important to the client than the capacity for cost effectiveness.

The design professional's role as owner's representative is further diminished by efforts to limit the financial exposure resulting from that role. That exposure was first limited by reducing performance obligations as the owner's agent. Performance obligations were gradually diminished from supervision to inspection to observation. Contractual limitations of liability for failure to fulfill the remaining performance obligations have reduced the owner's desire for such services. Further, potential liability for contractor claims due to errors in design presents an inherent conflict, as perceived by owners, when the designer administers the contract for construction. In each instance, the owner perceives the design professional as placing his or her own economic interest ahead of that of the client.

When retained by the design-build team, the expectations of performance by the design professional are greater than those typically found in the traditional owner/designer relationship. The designer becomes involved in the details of construction. Evaluation of the means, methods, and techniques of installation becomes

an integral part of the original design. This evaluation places responsibility for the constructability of the design onto the shoulders of the designer. For example, in the traditional construction process, the owner/developer implicitly warrants the adequacy of the plans and specifications. This warranty does not arise in a design/build setting. The design-build team is expected to exercise its own expertise in attaining the objective. *Sterling Millwrights, Inc. v. United States*, 26 Cl.Ct. 49 (Ct. Cl, 1992); *Aleutian Constructors v. United States*, 24 Cl.Ct. 372 (Ct. Cl. 1991).

6.3.8 The Professional Licensing Requirement for the Design-Build Enterprise

A design-build capability is essential for the design professional to survive and compete in today's construction market. The alternative is to offer specialized services, in addition to general professional services, to the growing market of design-build firms. General contractors face the same dilemma as the design professional. The design-build team, through contract, can impose the performance obligation upon contractors retained to perform the work. Unless the general contractor develops a design capability, the market available is increasingly limited.

The licensing statutes provide the design professional with a competitive advantage in forming a design-build enterprise. Contracts for professional services by non-professionals are, as a matter of law, void and unenforceable. Licensing statutes have prevented professionals from forming design-build enterprises by precluding professional corporations from engaging in any business other than the rendering of professional services for which they were incorporated.

The courts are presently circumventing the limitations imposed by the statutes to facilitate the development of the design-build enterprise. In *Charlebois v. J.M. Weller Associates*, 72 N.Y.2d 587, 531 N.E.2d1 (NY, 1988), plaintiffs entered into a design-build contract with defendants for a new warehouse and an addition to an existing building for the operation of a beer distributorship.

The contract was a standard AGC (Association of General Contractors) design-build agreement involving a design team with J.M. Weller Associates being the contractor and James M. Weller, P.E., the engineer. The plaintiff withheld \$600,000 in contract sums pending the resolution of construction disputes and sought to have the contract nullified because it violated the New York State licensing statute. The lower court enforced the contract, observing that the protections of the licensing statute were adequately addressed by the contractor's engaging a properly licensed professional.

The design-build contract required that an architect/engineer be retained by the design-build team and that all architectural and structural engineering services be provided by James M. Weller, P.E. The appellate court ruled that the design-build team did not agree to provide professional engineering services. Rather, the parties agreed that a licensed third party would perform those services. The plaintiff owner/developer was, thus, a third party beneficiary of the contract between the design-build team and the architect/engineer. The dissent argued that the design-build contract would allow a contractor to become a package dealer, resulting in the frustration of the public policy underlying the statutory licensing requirement.

The Court of Appeals ruled that the design-build contract did not constitute the unauthorized practice of engineering by the design-build team. The design-build contract

required the design functions to be performed by an independent third party who was not acting in the capacity of an employee of the design-build business corporation but, rather, as a professional licensed engineer obligated by contract to exercise his professional judgment in the interests of the public health and welfare.

The court enforced the contract, noting that to hold otherwise would have the effect of disenfranchising a fully regulated, professional engineer from participation in a commercial transaction of this nature. The regulatory sanctions, reinforced by potential civil malpractice liability, complementarily and proportionately protect the underlying public policy and protect the plaintiffs. The court noted the legislative objective to be professional performance, not the vehicle of delivery of that performance.

The dissent argued that the performance of Architect and Engineer services by a professional is insufficient to protect the public where the professional is also president of the unlicensed business corporation and, presumably, is beholden to that profit-motivated, commercial enterprise. A professional license is intended to guarantee that any services performed will be rendered in the exercise of independent professional judgment uninhibited by any outside influence or control.

The protection of the public health and safety depends at least as much on the professional independence of licensees as on their professional competence. The dissent observed that architects and engineers, as learned professionals, have a higher calling than pure profit motive. Concerns with time, cost restraints, allocation of resources, and profit margins will influence the professional independence of the engineer, and therefore the professional independence of the design professional is mythical.

The dissent in Charlebois assumes the design professional's retention by the owner limits the professional's profit motive. Direct retention impels the designer to over design rather than find the optimal design for a project. The design/build process restrains design excesses by exposing the value of the designer's services to free competition.

The dissent further observed that the financial interests of the licensee are inseparably wedded to those of the design-build team. The licensee may subordinate the owner's interests to those of his corporate employer. Where there is neither contract nor privity directly between the professional and the client, it is virtually impossible for the licensee to maintain a professional relationship of trust and confidence.

Charlebois reflects a current trend towards recognizing the legitimacy of the design-build enterprise. State legislatures have since adopted statutory schemes allowing business corporations to practice architecture and engineering directly by obtaining certificates of authorization.

The certificate requires the corporation to identify a licensed professional who is the corporate representative providing the professional service. Non-professional corporations must hire professionals by contract or obtain statutory authorization to offer and perform design services. Professionals may offer design-build services directly or may form a general business corporation authorized to perform design through their professional license.

The professional associations have developed standardized contracts for use on design-build projects. The AIA is currently revising document A191 in response to the 1987 revision to document A201-the General Conditions for the Contract for

Construction. The utility of the standardized documents is limited, however, as design-build projects, by their nature, are customized to meet the owner/developer's expectations.

Large design-build projects may involve public works or complex industrial facilities. The clients more often insist upon use of contracts developed for use by the particular government agency or by the particular client.

The standardized contracts identify design services as being performed by a separately retained architect/engineer. Customized contracts must be reconciled with the statutory licensing scheme as interpreted by the courts of each particular state to assure enforceability.

The liability of the design-build team, its agents, servants and employees, and losses incurred by reason of breach of this agreement or by reason of its errors or omissions, negligence, or otherwise is typically limited to the amount of insurance coverage available to the design-build team, its agents, servants, and employees to cover the loss.

Additionally, the design-build team normally obtains at its own cost and expenses the usual professional errors and omissions coverage within the usual limits and subject to the usual conditions and exceptions to coverage as is ordinarily carried by its business. Sometimes, the owner may direct the design-build team to obtain additional insurance other than as outlined in the proposal. The cost of such additional coverage is paid by the owner to the design-build team as an additional cost prior to the design-build team obtaining such coverage.

6.3.9 Our KPE Experience in Design-Build

Design-build projects have great benefits for owners and can create great market opportunities for designers and contractors. Since most of the design-build contracts are based on a firm price, it is absolutely necessary to fully understand the Scope of Work. Creating a “Joint Venture” between a contractor and a designer is the way to go. In my short experience in design-build projects, I have experienced projects where the Contractor is leading the project and we are hired as the contractor’s engineer. This creates a conflict of interest since we engineers want and need to comply with applicable rules and regulations but the contractor is more interested in the profit.

When a joint venture is set up properly, design-build can be a very rewarding experience since as a designer we learn about ways of making our design easier to build by listening to contractor suggestions. Moreover, the goal is to complete the work and not spend time blaming each other. The most successful projects for me have been those where the designer and contractor have the same weight in decision-making and have the same proximity to the resources (profit) as the owner.

Not all projects are suitable for design-build; those projects where the owner is not sure about the scope or not willing to take the risks associated with design-build are better kept in the traditional design-bid-build method.

Open communication develops trust. Within a joint venture, changes to the original design concept need to be communicated to the contractor for alternative solutions.

Existing relationships and the ability to maintain those relationships opens doors. Power plant owners in the country seem to be a small group, so it is important to do the

work right, and on time. Recognizing the owner's "hot buttons" and emphasizing design-build solutions help tremendously when dealing with contracting issues.

It is important to follow the procedures with no shortcuts; the delivery method may be different but the work is still the same.

Risk assessment and mitigation will help alleviate many uncertainties, resulting in projects completed on time and within budget

7. Current Situation of PKS

The goal of this Section is to examine existing information about PKS , obtain a better understanding of the type of work done by other district and the capabilities of the existing engineering services. Information presented here was obtained from internal annual meeting presentations, presentations given to future engineering partners and material available on the intranet. Some of the information is not up-to-date; nonetheless, it shows trends that are still valid about PKS.

7.1 Overview

PKS began operation in the 1940's, The Company is arranged by districts, and these districts are grouped in five categories: Building, Civil, Federal, Energy, and Electrical. See Figure 6-PKS Organization Chart. Typically the districts within the group are segmented according to location.

The civil department that desires to grow belongs to the KPE district, which in turn belong to the Energy group. The Energy Group employs about 2,000 people. Depending on the size of the project the Energy Group sometimes partners with the Federal Group, and occasionally with the Building Group.

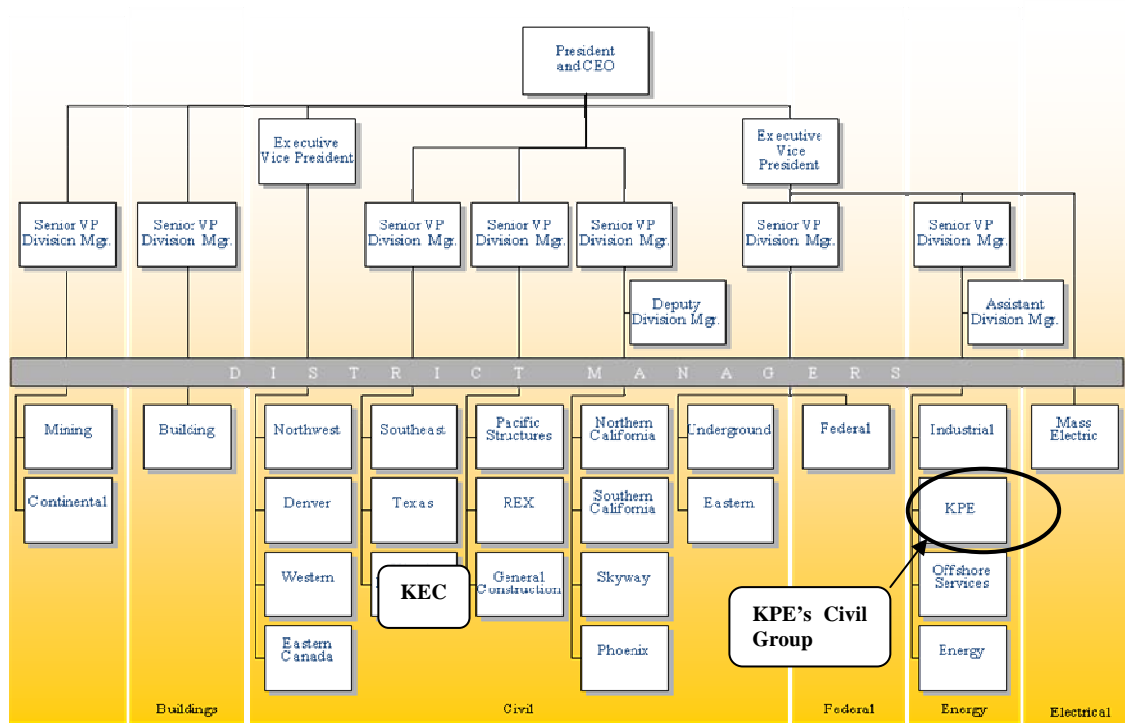


Figure 6-PKS Organization Chart

Most of the construction work related to the civil discipline takes place in the Civil and Federal Groups. The projects constructed in these categories are highways, airports, and storm sewers. The following pictures show examples of some civil-related projects constructed by PKS. Most of the highway work done is located in the western part of the country, with a strong presence in California, Arizona and Colorado. Projects belonging to the Federal group are mostly located in the eastern part of the country.



Figure 7 Highway constructed by the Transportation group

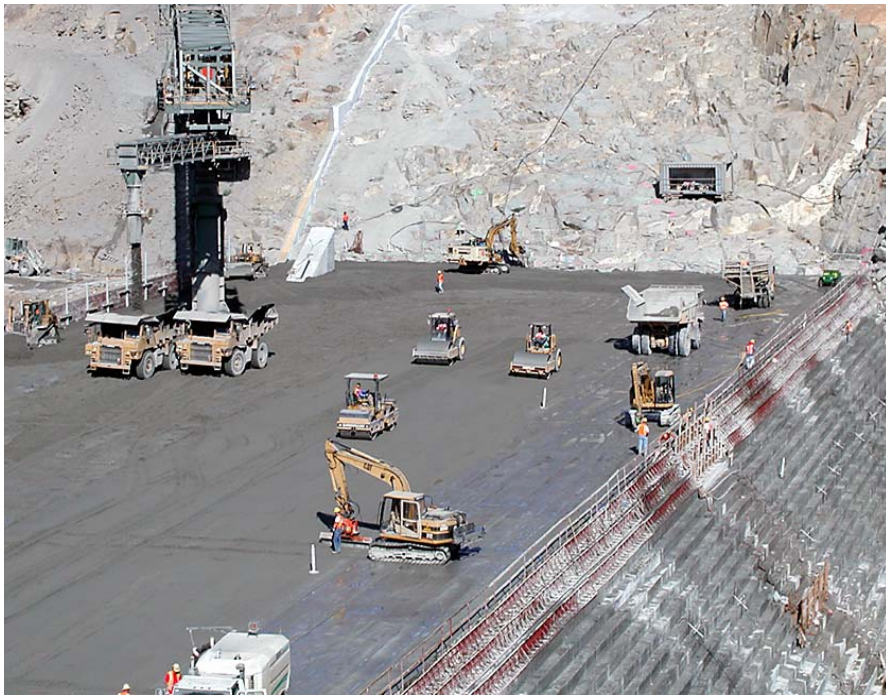


Figure 8 Dam constructed by the Federal group

Districts are organized by type of work and geographical location; It is common for more than one district to participate in building a particular project. For example, a

power plant could involve a combination of the Denver, KPC and Federal districts. The following figure shows the geographic locations of the districts.



Figure 9- Districts Location

Districts are diverse in both their numbers of projects and their annual revenues. In any given year, one district might have annual revenue of about 1.5 billion dollars, while another district might only make 300 million dollars. The explanation for the gap in the annual revenue among districts is mainly the type of market where the projects take place. The financial strength of the company is founded on the diversity of the projects constructed. Figure 10 PKS Variety of Work shows the types of projects built by PKS.

Depending on the economy, it could be the case, for example, that the transportation industry has an excellent year, while the power industry remains weak. For the year 2009 it is expected that work on building will slow down, yet the power industry is expected to remain steady.

Markets

Wide Variety of Work

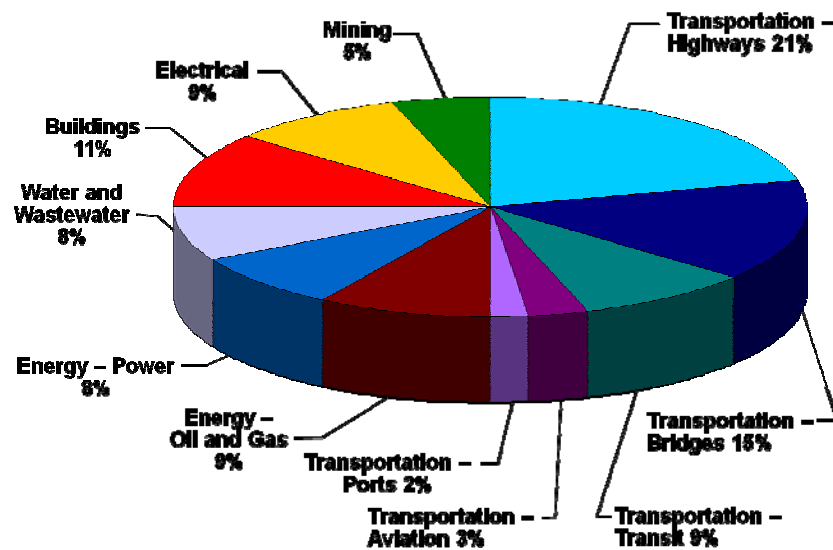


Figure 10 PKS Variety of Work

The company has grown into these different markets gradually. The following table shows the types of projects the company used to have 20 yrs ago.

	PKS Circa 1990	PKS Today
Roles	General Contractor	General Contractor Design-Build Construction Manager at Risk P3 Developer
Markets Transportation	Highways Bridges Aviation	Highways Bridges Aviation Signature Bridges Transit Ports
Energy - Power	Power Plants - Gas-fired	Power Plants - Gas-fired Power Plants - Coal-fired Power Plants - IGCC
Energy - Oil and Gas	Offshore Fabrication	Offshore Fabrication Refineries Ethanol Plants LNG Facilities
Federal	Department of Defense	Department of Defense Department of Energy
Other	Water and Wastewater Buildings Mining	Water and Wastewater Buildings Mining Electrical
Selection Criteria	Low Bid	Low Bid, A+B, Best Value
Project Size	Small to Medium	Small to Medium to Mega

Figure 11 PKS Evolution based on type of projects

In addition to the diversity of markets, PKS also takes on a variety of projects regardless of their size. The idea behind taking on both small and big projects is that small projects shield the company when a single big project goes bad. Spreading the risk to several project sizes allows the company to predict a stable source of revenue, regardless of whether a big project gets suspended or its finances are delayed. A second benefit of taking on small projects is that small projects provide an excellent training opportunity for future project managers and supervisors. The following figure shows the number of projects by size built by PKS in one year.

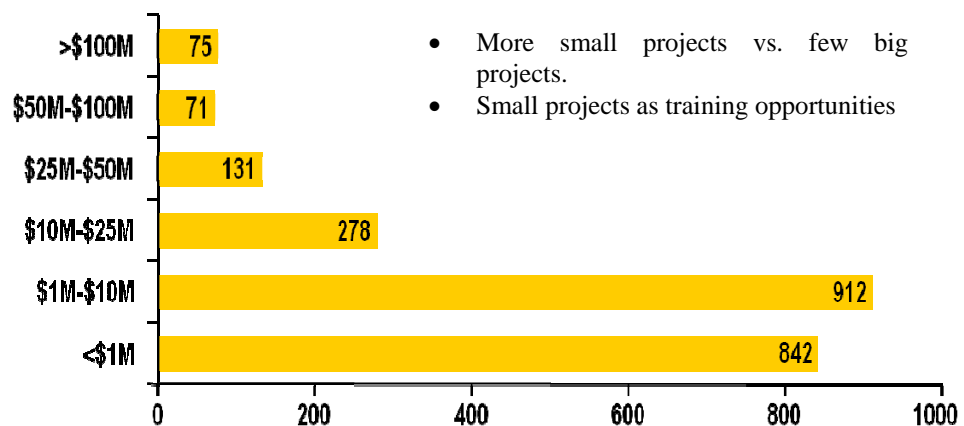


Figure 12 PKS projects by size in millions of dollars

The company cannot be fully described without talking about safety. The construction industry has a significantly higher level of injuries in comparison with any other industry.

A construction company with a good safety record is not only good for the employees, but also for owners as assurance of the company's attention to details.

PKS has had significantly lower numbers of recordable cases than the average in the industry. Figure 13 Safety records shows that trend. More recent years were not available to be included in this paper. However, the number of recordable accidents at PKS is normally six to seven times lower than the industry's average.

Lower safety incidents means lower PKS premiums for insurance cost, and keeps the project on schedule.

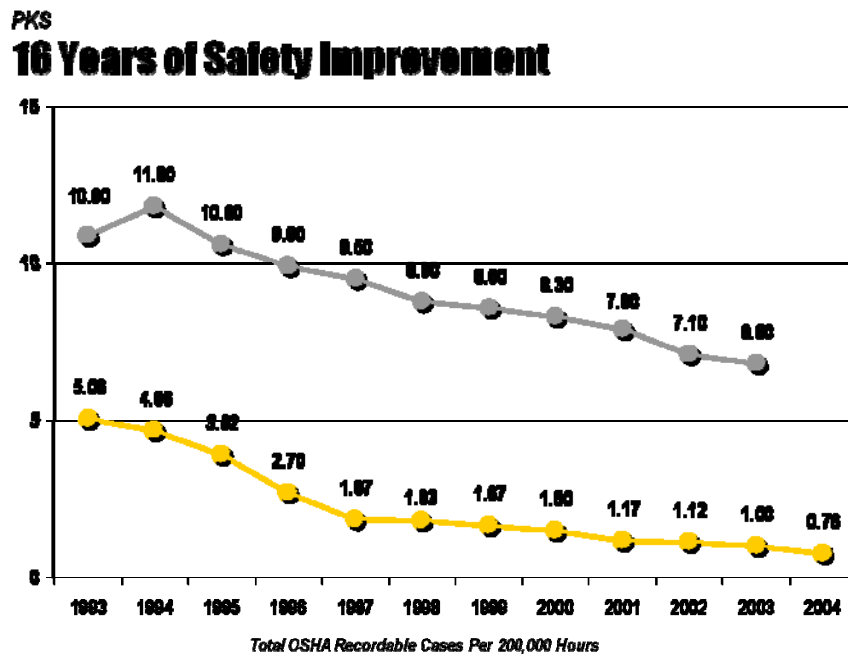


Figure 13 Safety records

7.2 Partnering and Outsourcing

The company has evolved by accommodating changes in the construction industry. Twenty years ago, most of the revenue was from traditional design-bid-build projects. However, in recent years, the company has taken on more design-build projects. See Figure 14 Trend Design-Build vs. Traditional PKS

Some districts are better-suited for the traditional way of building projects. Design-build requires a different philosophy from the constructor. For some projects, the culture of the district would not be suitable for a design-build format where the builder has to work side by side with the engineers. Other districts, however, are quite comfortable and profitable doing design-build projects.

PKS as a company has developed a design-build support group in the home office. The function of this group is to assist the districts by applying lessons learned from other design-build projects and by facilitating the selection of engineering partners. The shift from traditional projects to design-build is represented in the following figure.

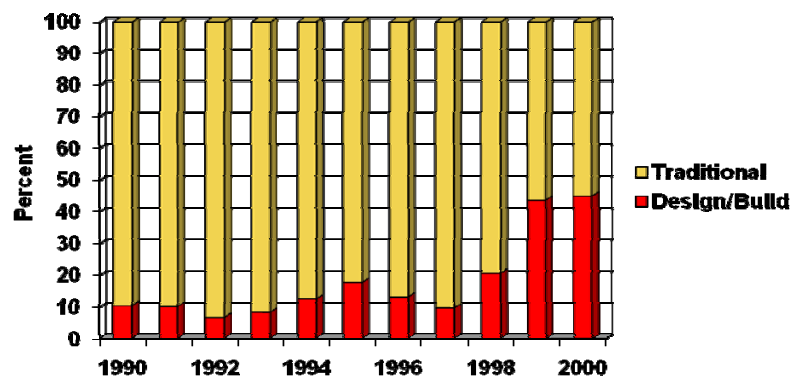


Figure 14 Trend Design-Build vs. Traditional PKS

7.2.1 Joint Ventures with Other Engineering Firms

PKS partners with several engineering firms to design and build highways, power plants, sewer plants, buildings, etc. Engineering firms that have partnership agreements with PKS are included in the following table.

Associated Engineering Bentley Architects Buckland & Taylor CH2M HILL Dibble & Associates DMJM Harris DMJM Harris/Delcan/ IBI Group Edwards & Kelcey Hatch Mott MacDonald HDR (2)	Lichtenstein Consulting McCormick Rankin ND Lea (2) Parsons Water & Infrastructure PBS&J (2) PN+D PTG (5) PTG/HNTB PTG/Washington Group Washington Group/URS
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Table 3 PKS Engineering partners

When partnering with engineering firms, PKS has certain key requirements for evaluation which include:

- Good recent experience and good relationships with the owner
- Key staff (most importantly, design manager)
- Capacity to perform the work
- Willingness to co-locate
- Willingness to sign our subcontract for design

Other so called intangible characteristics are also measured; they include:

- Open, honest and frank
- Executive involvement
- Make good on commitments
- Do what you say you will do, when you say you will do it
- Proposal support
- Ability to give us a competitive advantage
- Willingness to invest in success
- Project delivery
- Meet budget and schedule
- Control construction scope growth

According to comments from district managers and information available on the company intranet, partnerships for the most part have been successful. However, they could be improved by having more co-location with the engineering partner and by having the same system to track deliverables for both parties. On some projects, the project schedule has not been able to incorporate the engineering schedule in an efficient manner due to the different procedures that the engineering company used to track schedule and budget. Some projects have also been delayed due to the slow response of the engineering firm in submitting drawings and specifications for construction.

7.3 Existing Engineering Services Within the Company

7.3.1 KEC

The most well known engineering services within PKS are the engineering services for support during construction (KEC). KEC is structured to support the other PKS districts in the area of estimate support during the bidding process. That is, KEC would provide a second estimate to a project bid for all districts. This is in line with the company's policy of having a second estimate on the project bidding process. Additionally, the KEC group provides engineering services in the disciplines of structural, geotechnical and construction. The purpose of the work is to expedite and provide valuable input on how to better build a project already designed by a third party. KEC employs about 75 people and it has been growing at a rate of about 10-15 people per year in the last three years. The subdivisions of the districts are shown in the next figure. It is expected that KEC could reach 100 employees by 2010.

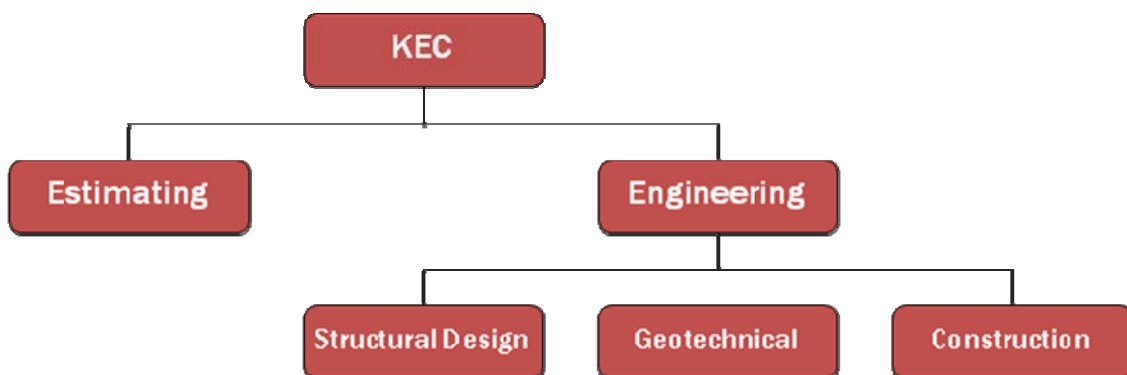


Figure 15-KEC group organization

The engineering services provided by KEC are not “design” services. That is, KEC does not produce stamped drawings or documents for construction. Instead, their involvement is purely to provide support to the construction team.

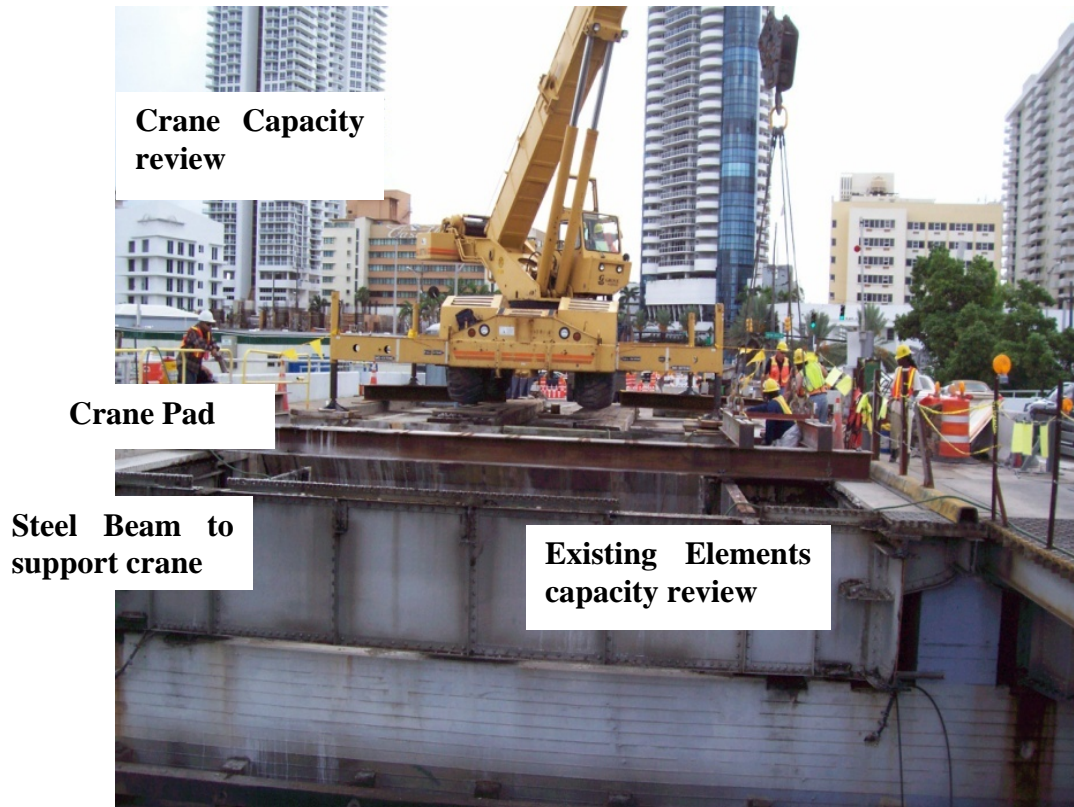


Figure 16 Temporary structure design

Figure 16 Temporary structure design depicts some of the elements designed by the KEC group. These structural elements are essential to ensure safety and provide efficient work operations during construction. It is worth pointing out that KEC does not advertise engineering services in the area of site preparation, mainly due to the lack of resources.

KPE's civil group has already contacted the managers from KEC and has cleared the path by making sure that there is no overlap in the services offered. Last summer, a meeting was held between KEC and KPE's civil group to discuss the potential for sharing work within the two districts. After the meeting, one manager at KEC said he was receptive to the idea of increasing engineering services, regardless of where it happens (KEC or KPE), and will support transferring work related to site preparation (grading and drainage) to KPE's civil group.

7.3.2 KPE

KPE was acquired by PKS about 4 years ago. KPE designs power plants and has increased its participation in air quality projects, ethanol plants and chimney design. Most of the districts are not familiar with KPE since the main focus of the company is to serve the Energy group. KPE has grown from a small, start-up engineering firm to 400+ employees. KPE is well-known to the KPC and Southern California districts since they partner with KPE to construct power plants.

KPE is subdivided into the following groups: Operations, Accounting, Human Resources, and Marketing. In turn, KPE's Operations Division is subdivided by disciplines: Civil, Structural, Mechanical, Electrical, and Instruments & Controls. The Operations division represents about 80% of the entire KPE organization. Since the KPE district is growing and the power industry does not seem to be slowing down, KPE is starting to receive more recognition within the PKS organization. The idea of having a solely-engineering firm within the company is a new concept for some district managers.

Despite the fact that some districts managers know about KPE, they do not necessarily see a connection between their district and KPE, since KPE is perceived as solely dedicated to power plant design.

KPE experience in designing and building Power Plants with other PKS districts has given this district a good reputation for quality work. Sometimes, depending on the client, PKS or KPE may choose a different partner for a specific project. This is not uncommon since developing a long term relationship with a client may take many years and proven results.

7.4 The Current Setup for Internal Engineering Services

KEC participation with other districts is normally set up as an engineering subcontract on a time and material basis. KEC charges the district per hour until the task is completed. In order to make this attractive to the districts, and in recognition of the valuable input KEC can provide in projects, the labor multipliers used for KEC's hourly rates are low compared to the rest of the industry. In this scenario KEC is not set up to be a profit-generating district. Instead, it is set up as a support service.

KEC revenue for hourly charges is only a portion of the total amount of KEC work. Most of the work is set up as a partnership with a district. That is, a charge is made on an hourly basis with a low multiplier, but then the overall profit or loss on the project is shared between the construction organization and KEC, in a ratio proportional to the amount of hours spent by each of the parties to complete the project. Due to this setup, KEC's annual profits are not comparable to an engineering firm of the same size, and the real measure of their success is the satisfaction of the rest of the districts in having a reliable in-house engineering firm.

Despite most of KEC's personnel being licensed professional engineers, KEC does not provide design documents for construction or permitting. Rarely will they stamp a drawing or issue a specification.

On the other hand, KPE's district is a profit-generating center and it has all the legal responsibility of an engineering firm. Most of the work done at KPE is done as a joint venture with another district, or with construction companies other than PKS.

KPE is a multi-discipline engineering company. Most of the professional engineers in the company are either mechanical engineers (about 150) or electrical engineers (80). This is due to the nature of the projects (power plants). The rest of the disciplines, Civil, Structural, and Instruments & control, are seen as support groups. KPE is licensed in many states as an engineering company; most of the professional engineers in the company have valid licenses as engineers in most of the states.

Financially, KPE gets about 40% of its revenue from the hourly charges to the owner or the joint venture. The rest of the revenue comes directly from the profits generated for the entire project and shared with the construction team.

On legal matters, KPE has several employees with enough knowledge to address legal matters related to contract reviews, and to understand the terms and conditions, and how to set up joint ventures. KPE does not have a legal department; instead, we rely on the expertise of the legal department in the PKS home office for a final review of the contracts.

Since most of the partnerships are with other PKS districts, the terms and conditions are simple, and most of the contract focuses on risk allocation and profit-sharing. Risk allocation is important since we need to shield PKS (perceived as having large amounts of cash) from errors and omissions committed by KPE in its engineering tasks.

Quality is to KPE as safety is to PKS. In fact, PKS' districts that have worked with KPE have been very satisfied with the level of quality and the processes and procedures established at KPE.

KPE's involvement in projects with PKS is limited to Power Plants and a few Ethanol Plants. PKS and KPE have developed procedures and techniques to improve quality in the construction of Power Plants.

KEC and KPE represent different philosophies of setting up a business. KEC functions more as a support company, while KPE must make money to exist. Growing KPE's civil group may require a combination of the two for the short term, while we develop recognition in the company. However, besides creating more career opportunities for engineers, KPE's civil group needs to be able to generate a profit for KPE; otherwise it will not gain support.

When more work starts coming our way, and the executive vision embraces providing civil engineering support to the other district with a low labor multiplier, then it would make more sense for the group to become part of the KEC organization rather than KPE.

7.5 Potential Market

7.5.1 Additional Work Within the Energy Group of PKS.

Some Division Managers at PKS Energy Group have expressed concerns about the lack of good Civil/Structural engineering in projects where KPE is not a partner. The reason for the concern is scheduling risk. For example, the contractor can quickly start grading the site and constructing foundations as soon as the drawings are available for construction. However, if the engineer is late with the deliverables, or is not working in sync with the contractor, the entire schedule for the project could be affected. The Division Managers at the Energy Group also noticed the efficiency and responsiveness of the Civil/Structural Department at KPE, and would like to explore the possibility of KPE performing the Civil/Structural design of PKS's Projects regardless of who is the engineer partner for the entire project.

KPE's president has communicated these concerns and opportunities to the Civil/Structural group and has requested a plan of action. The proposed plan is to meet with project managers and district area managers to learn specifics about the issues and together find ways to solve them. In some cases KPE will be the solution. However, we need to determine if the scheduling issues are being prompted by unrealistic schedule being given to the design professional. If so, then the solution is to work with our PKS estimating group on better accounting for engineering services scheduling.

The following figure shows the relationship of the players mentioned in the previous paragraph, the Energy Group has two districts: Power Constructor and Power Engineers (KPE).

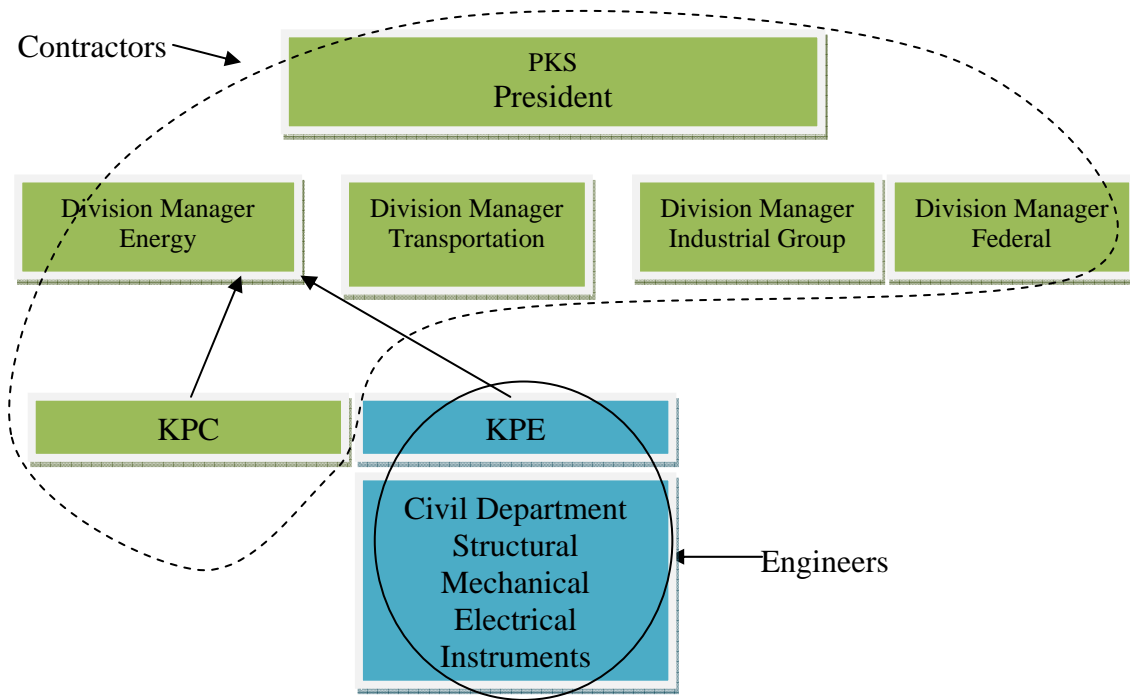


Figure 17 Current situation-buyers

7.5.2 Other Districts

Transportation

The Transportation Group is probably the largest group in PKS, accounting for about one quarter of the entire PKS revenue. Historically it has been a very profitable group; PKS started doing highway work back in 1950. Since then the group has become established as one of the most well-known highway builders in the United States.

Most of the work done is government work either through a traditional design-bid-build method or design-build by partnering with a well established engineering firm. Given the amount of work they have, it is likely that they will need support for designing temporary roads, or access roads, for use during construction activities. There could be

opportunities to do design-build work with them on small projects where name recognition is not an owner concern, for example: private roads, parking lots, and interior roads.

Industrial

The Industrial Group types of work include: ethanol plants, assembly plants, warehouses and production facilities. The potential for work with them is in developing the grading and drainage package for site preparation for these facilities. The KPE civil group already has had the experience of developing an ethanol plant for the industrial group.

Federal

The federal group partners with other districts to build power generation facilities, reservoirs, waste water plants and bridges. At the time of this paper there is not much information available about their projects and how to partner with them. Likely those projects could benefit from a combination of road design and site preparation.

8. How to Improve the Current Situation

8.1 Identify Existing Needs

Most of the districts already have a well established way of doing work. Whether the engineering work is done by an outside firm, or by partnering with a big engineering firm on design-build projects, PKS has a well established set of procedures to ensure quality on all the projects. The challenge then becomes, first, to learn in what areas those procedures need improvement. In such a big company, chances are that some needs are not being met in some way. By listening to managers from other districts, needs like the one described in Section 7.5.1 will emerge. Careful planning needs to be done before the first sales call, in order to learn the needs.

The hope is that, after listening to the needs, district managers will be persuaded to work together with KPE's civil group to finding a way to meet those needs in-house. If, after learning the needs, they decide that the current scenario has little room for improvement, then at least we will have the knowledge that working with that district is not realistic.

Appendix A and Appendix B provide tools to assist in gathering information from other districts.

8.2 Matching Needs with KPE’s Civil Group Strengths

If the goal of KPE’s civil group is to become the “go-to” civil group for all design-build work in PKS then we need to start with small steps. For example, we should find the current needs of the districts in regards to civil and structural work, and then match those needs with the capabilities of KPE’s civil group.

8.2.1 KPE’s Civil Group Capabilities

Our capabilities are: understanding of design build work, that quality work aligns with PKS philosophy, survey procurement, grading, storm water management, road design, and railroad design.

- Understanding of design-build work: Our group has gained the experience and communication skills to work closely with our contractor partners and owners to achieve an efficient site development design in a prompt manner.
- Quality work: Following KPE’s goals and reputation for great attention to quality, the civil group has developed checking procedures that reduce the potential for re-work and change orders in the field.
- Survey Procurement: Our group works closely with local surveyors in order to obtain accurate and timely information on record of survey and existing topography, and a clear understanding of the different coordinate systems.
- Grading: Using 3D Modeling Tools like Geopak and Inroads, we are capable of providing a quick turnaround on quality site-development design.
- Storm Water Management: We have experience in complying with agencies from different states concerning storm water quality and quantity regulations.

- Road Design: Our geometric designs provide for drainage and erosion control.
- Railroad Design: We are capable of designing Railroad Class I facilities including mainline improvements and intermodal facilities.

8.3 Sharing Work Leads to More Career Opportunities

Bringing work to the KPE civil group will be productive not only from the short term profit perspective, but will also allow engineers to better develop their careers by being exposed to the construction side of our business in projects related to our discipline (civil), rather than by working projects where the civil work is only a support function.

8.3.1 Developing the Future Master Builder

Most of the districts already have excellent career development programs for their employees. The career development program gives the employee the opportunity to learn construction fundamentals the PKS way. The program's framework exposes the employee to positions and tools that will help the employee to succeed in the management of construction. The program is structured to extend over a six year period. Each component exposes the employee to the technical, managerial and leadership skills required to have a successful career within PKS districts.

A good part of the training is "on the job;" in addition, the employee is exposed to a variety of structured training courses, both at the home office and district level.

The program's success is evidenced in that 34 of the top 37 managers in PKS were hired at the college level and were developed through training and hard work.

The development program guides the employee through the following stages of their career: Estimating, Office Engineering, Scheduling, Field Engineering, Quality Field Engineering, Procurement Engineering, Lead Discipline Engineering, and Project Engineering.

The new variable then becomes how do we prepare future company leaders to be capable of understanding all the topics related not only to managing construction but also to managing design professionals. One solution is to share work among the construction and design districts already existing in the company. Perhaps modifying the existing career plan to include aspects of design will lead to a more prepared engineer.

For example, when PKS hires new graduates, they could be given the opportunity to work on engineering the site preparation for a power plant. This could take place in the first year of experience. In the second year, the employee could be exposed to work done by KEC in estimating highway work. Then in the third year, a field assignment on constructing either the power plant or the highway would allow the employee to learn about the construction operation.

After this exposure the employee will be able to better decide what career path to follow by choosing construction, design or maybe a combination of both construction and design while working on design-build projects. There is no reason why a capable engineer should be restricted to working on construction or engineering only.

8.3.2 Design-Build

KPE's group can take on small design-build projects. The concept of using small projects as training opportunities is a common practice in PKS (See Section 7.1). Our group already has experience working closely with our construction partners in power plants. We know how to work side-by-side with construction workers and have learned how to create a cooperative environment between engineers and contractors.

Perhaps this is the best chance of quickly expanding our business, since in certain projects; the owner would not be interested in knowing who does the work as long it gets done well and on time. Here, our disadvantage of not being known as an engineering firm would not be a factor, as in such projects as, for example, to build and design a private road, the grading for a building, or the layout for a railroad yard. Insurance and legal advisors always advise design firms to start small when taking on design-build projects since a single project can kill the entire enterprise (Quatman II, 2001)

8.4 No-Change Scenario Means Lost Opportunity

Several opportunities could be missed if the KPE civil group does not get more work from other districts. The first missed opportunity would be the lack of career opportunities for members of the team since their career paths will be limited to performing the design of power plants only, where there is a limited amount of work, and the civil engineers would have to compete for management positions against other disciplines like mechanical engineers, who have a perceived higher ground of the knowledge in the project. This, in turn, would translate into the possibility of not retaining valuable people within the organization after they have acquired certain expertise.

If the options for career advancement are limited due to the amount of projects, then it would be harder to make the case for hiring people, since they would not be given a choice to pick among other districts.

In the long run, the company would be less prepared to address the market's concerns by not having a sizable work force that could design and build any type of project, and not only power plants.

8.5 Value Proposition

In order to have a complete value proposition, as will be described in Section 10, it will be necessary to get input from the customer first, and then formulate the value proposition based on that information. However, for the purpose of this paper, I would like to formulate a value proposition based on information I have gathered from our internal PKS communication records, such as magazines, intranet and talking to PKS employees with knowledge of other districts.

It appears that a recurrent issue is the lack of reliability of small civil engineering firms on design-build projects. Small companies lead the contractor to believe that the design will be done at a certain time, yet since they don't have enough employees to meet the schedule, they end up delaying the entire project. Another concern is that even the big engineering firms, when working in partnership with PKS in design-build projects, do not have the same way of thinking as the construction firm. That is, the contractor will try to direct the engineer to implement certain considerations on the design based on constructability improvements, and the designer will not listen to the request, or feels that his authority is in jeopardy. Another claim about the current conditions is that PKS needs more engineers to do estimates and design support during construction activities, since KEC is understaffed.

Based on the comments above, let's identify some of the basic concepts of value proposition as applied to our case.

Who is the target? The targets for the value proposition are the other districts within PKS: i.e. Transportation, Federal, and Industrial.

What is the expected schedule?: The expected time to implement a value proposition may be several years, but it could be initiated with existing capabilities for the first two years: Site preparation, SWPPP preparation, Storm Water and then expanding to bigger projects after earning trust from the customer.

What is the proposition offered? The proposition made is to provide engineering work to the civil engineering group derived from construction activities including site preparation, storm water management, and storm water pollution plan.

The services offered in our proposition are listed next:

Site preparation: Generate a 3D model of proposed grading allowing for fast and quality work on estimates quantities.

Storm Water Management: Address storm water management design, construction, and post-development.

SWPPP: Storm water pollution prevention plan preparation.

Roadway design: Generate a 3D model design of road during construction or permanent.

Railroad design: Class I Railroad layout design.

Training: Geopak, Microstation, Inroads.

Field services: On-site engineering for quick response.

What are the alternatives to the proposition? The alternative to our value proposition is the utilization of small civil engineering firms located near the project sites. The rationale here is that a small firm will be cheaper, and will have local knowledge of the land or permitting agencies involved, which would be advantageous to the project. Unfortunately, in a design-build setting, more often than not, the construction firm will be

affected by an unreliable local engineering company without previous working experience with PKS, and having an expectation that their contract is a one-time deal with PKS.

What are the expected benefits or resulting experiences expected from implementing our proposition? The benefits are:

- Schedule-driven approach vs. small local firm driven by work load.
- Work closer with design implementers vs. small firm working on their own.
- Keep money in house.
- Develop our own PKS people thru cross-training.

8.5.1 On KPE's Civil Group Versus Alternatives:

- We understand PKS priorities: no “on-the-job” training, quick response and schedule-based approach.
- Our engineers will benefit from cross-training.
- Long term solutions approach, we are planning to be here for the next one.
- Promote build master concept.
- Keep revenue within company.

8.6 Handling Legal Objections

After learning the many legal implications of doing engineering work (see section 6.3) , perhaps the wisest thing to do is to know our limits on legal matters, and seek counseling from the PKS legal department as much as possible. However, the following points are expressed as a general knowledge acquired while researching for this paper.

8.6.1 Excessive Risk

Perhaps the most common phrase among district managers on hearing about doing more engineering instead of construction work would be the concern of doing something where they are not fully knowledgeable of the legal risk they are about to take, and therefore simply saying “no” to the proposition.

My response to this comment would be first to better understand the nature of the objection, if it is about how to setup and properly allocate risk then there are five options about how to handle risk: (1) Insure it, (2) Share It, (3) Avoid it, (4) Shift it by contract, or (5) Accept it. (Quatman II, 2001)

KPE is already set up as different companies in the sense that legal issues in one area will not spill over to the rest of PKS. Therefore if KPE decides to take the risk, it will be no different from when that construction district subcontracts the engineering work to an outside firm.

In the case of a design-build project, a new agreement needs to be drafted between the district and KPE specifically about the project where the work will be shared. KPE already has similar design-build agreements with PKS districts used when building power plants. From our perspective, we need to make sure that the work we

take on is within our competence and that we will be able to perform to the applicable standard of care for that task.

Since we have not performed a contract with a district for Civil work only, we should spend enough time to understand how risk is being allocated. It is my hope that districts will see the long term goals and will draft contracts that are fair and reasonable to both parties.

Regardless of being the same company we must be careful to prepare contracts that clearly separate the duties and obligations for the design professional and the construction team. This could be of special difficulty on tasks that involve inspection of field operations, if the owner hires KPE as resident engineer to see that the work called for by the plans and specifications is performed satisfactorily.

8.6.2 Who's the Boss?

Most of the design-build work is done by contractors; the reason for this is that contractors have the bonding capacity, as well as experience in pricing and managing multiple trade subcontractors (Quatman II, 2001). Engineers could be in a position where their efforts are perceived as a commodity if the contractor does not fully understand the value that the design professional brings to the team. Lack of mutual respect between the contractor and design professional could lead to miscommunication and missed opportunities to work as a team to solve the project's challenges. It is not important who is in the lead as long as the role of the engineer and the contractor are well defined.

Trust is very important in design-build,. Since the other districts are already part of the PKS company, it should be easy to sell the need to plan for long term solutions while taking care of the project in hand.

If the project is set up correctly, the adversarial relationship between engineers and contractors typically seen in the traditional method will be replaced with teamwork. If the design-build project is an engineer-led project then the engineer may be accepting more risk than when performing design-only or a contractor-led project; therefore having the contractor as a lead on the project would be a better setting

8.6.3 Making Money

As with every start-up company, there will be a need to start with a small task given by another district,. This may require an initial investment from KPE in time and perhaps in lowering our labor multiplier rate to be competitive with smaller firms. As we keep progressing toward acquiring larger tasks and have created some reputation, then we would need to transition to our regular rates in order to be profitable.

The task we need to go after in the beginning may not be as financially rewarding compared to the existing projects at KPE, but it needs to be seen as an investment for a long-term solution. The initial tasks might involve road design, railroad design, site grading, and storm water management on a smaller scale (about \$50K to \$200K), and then escalating to entire projects. The type of project to take on when doing design-build needs to be low-risk, or where the output requirement is not established, such as a power plant. Particularly good projects to chase are those that are similar to the tasks done as a

design firm only. There is no need to take additional risk; we can wait for the right project to come along.

Another way to start to start participating in projects is by offering construction management (CM) services. This could be a way to ease into the role of contractor without all the risk. If there are construction defects in the work, the subcontractor warrants the work to the owner and the construction manager. However the problem with this setting is the lack of control. The subcontractor has no incentive to listen to the construction manager since the contract is with the owner and not the construction manager.

However, if instead of working as construction manager only, the scope is design and construction management, then the engineer can gain some control, for example, by inspecting that work is being constructed according to plans and specifications prepared by the engineer.

The second concern with offering construction management services is the potential of increased exposure to liabilities for site safety issues. The rewards of design-build do not come without a price. Compared to the traditional method where the goal is to keep the owner satisfied, design-build is not only about keeping the owner satisfied but also deals with other subcontractors and makes sure that schedule and budget are in good condition throughout the entire duration of the project.

9. Conclusions

I have worked in KPE for three years now; I have witnessed the change in mentality from a very antagonistic relationship between my engineer coworkers and our construction partners to a teamwork mentality. At the same time, construction districts partnering with KPE have learned how to work with us. Today we have several projects (power plants) where the construction team and the design team are co-located in the same part of the building. On those projects, it is hard to tell who belongs to construction or who to design, since we work very closely with each other in generating solutions for the projects.

It is very helpful to have the construction supervisor provide input on how to optimize the design based on the equipment to be utilized in the project. At the same time, when the design engineers explain the reasoning behind certain designs and the need to comply with applicable laws and regulations, it promotes a certain sense of buy-in from the construction team, and reinforces our common goal.

The attention of the team then turns to how to achieve the same goal either by improving the design or by changing the method of construction. Our company procedures now reflect our adaptation to the design-build methodology. Seeing the effects of the combined effort from design and construction have prompted me to research more about how to expand our engineering services within the company.

The first task, then, became how to approach the potential market: the company management team. For this I have chosen an approach called the Value Proposition. Having a structured way of offering engineering services would be of great help. The

academic value of researching many sources to become more familiar with the subject will pay off with time.

The value proposition is about placing the customer's needs first. The value proposition is just part of the "Delivering Profit System." Due to the limited information available, it is not possible for this paper to form a complete value proposition for the desired goal, yet it will serve as a starting point for selling the engineering services within our company.

The KPE civil group's Value Proposition to other PKS districts could be summarized as this:

We provide civil engineering services, including grading and storm water design for during-construction facilities and post-development conditions. Our experience with design-build projects allows us to serve PKS districts in a way that an outside company will never match, since we are able to work closely with the construction team to meet the project schedule. Districts will benefit greatly from having a reliable pool of civil engineers that can perform construction and design services. Adding a set of civil engineering services will complement the existing services provided by KEC.

We need to communicate our Value Proposition in a systematic way to the district. We need to communicate that the benefit is not only a short-term gain in profit, but also the ability to develop people that will be better prepared to lead our company in the future.

I have included Appendix A and Appendix B as templates to use in sales calls with the other districts. These templates were created during the EMGT program.

Researching the use of a value proposition has led me to believe that we can use this system as long as we complement the value proposition with a good delivery system. This will be a work-in-progress for some time. Most of the districts will be contacted next year. We won't be able to evaluate until then whether using a value proposition as a tool to deliver our engineering service is the right method

Writing Section 7 allowed me to see PKS in a different manner. It gave me a better perspective of the company's strengths and how we compare with other construction companies. I believe what I learned when writing about my company will place me in a better position when explaining my engineering services and how they fit within the entire company.

Even if there is no need for expanding my engineering services, my hope is that by using the tools I learned from writing this paper, and by learning about the legal issues we may face, decision-making managers in the company will learn of my own capabilities, and future opportunities may arise.

The second goal of the paper was for me to become more knowledgeable about the legal aspects of offering engineering services. This was perhaps the most rewarding part of doing this paper. I have expanded my interest in Law by gaining an elementary understanding of how the law works.

After taking EMGT 812 Law and the Design Professional, I have recognized situations that gave rise to legal questions, and sought legal advice from a professional in that area. In addition, I have learned that developing a sensitivity for potential legal problems is a goal attainable in a relatively short time.

It is difficult to equate engineering with law. It seems the first is based on logic and repeated observation, but experience and analogy are more important in the process of legal thought. Engineers are hired to use applied science to solve a problem, whereas a lawyer is engaged not to find the truth but to present his or her client's position, and counter the opponent's argument without subverting the truth.

There are several legal considerations very applicable to my everyday job. For example, I learned that when writing a document or a contract, if the terminology used is vague then it could be construed against the person who drafted the contract. This is important for us, since we often review EPC (Engineer-Procure-Construct) contracts, where we add items with the goal of addressing a potential design issue. Sometimes the information to clarify the potential design issue is not available, and the text added to the contract could be vague.

Every day, we work with construction partners that have learned that means and method are the responsibility of the contractor only. When we engineers add workmanship items to our design specification, it is seen as stepping outside our engineering boundaries. After reading Bockrath (Bockrath, 1995), I understand clearly that the engineer could add workmanship specifications to the contract; however, the engineer will then be responsible if the contractor performs according to those specifications and the result does not match expectations.

Quatman (Quatman II, 2001) has excellent information about design-build methodology. It was very helpful to learn the different ways design-build could be set up. Applied to our case, when doing design-build work with other districts, it is more likely that the contractor will be the lead on the projects. From a liability standpoint this

is a better setting for the engineer; however, the roles of our design team and the construction team need to be well-defined.

It is unlikely, that we will do design-build in civil engineering projects with other PKS districts in the short term. Most likely, owners will prefer to use an engineering partner for the design-build team that has experience and a reputation for building similar projects. Nonetheless, we can partner in small projects to gain that experience, and thereby strengthen our company and enhance the careers of our engineers.

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11. Appendix A

ADAPT Script Template

Assessment Questions:

- 1) What type of results are we (PKS) getting from our current setting for the Civil/Structural design on Engineer-Procure-Construct (EPC) projects?
- 2) In your opinion why is Civil/Structural design important if it only amounts to a very small percentage of the overall project price?
- 3) What are the two main concerns about Civil/Structural design on EPC work?

Discovery Questions:

- 4) How many projects does the PKS Power group normally construct in year?
- 5) If the Energy group constructs X projects per year, and KPE only designs about three or four of them, then as a company we have X-3 projects whose Civil/Structural design is done outside PKS, is that correct?
- 6) How about the Transportation or Industrial Group?
- 7) Do you see any legal or contractual obligations that will stop us (PKS) from taking the Civil/Structural design out of the X-3 projects and doing them in-house?
- 8) What do you think about the Civil/Structural group at KPE?

Activation Questions

- 9) If currently we are losing X-3 projects with Civil/Structural design worth approximately \$500,000 each then PKS is losing about \$50,000 profit. Is that correct?
- 10) More important, we are at risk of having X-3 projects starting late due to delays in the Civil/Structural design. And according to your comments on 3), it seems that the amount of money and reputation that we could potentially lose goes way beyond the \$50,000 profit per project. Do you agree?

Projection Questions

- 11) Now, if KPE could provide PKS with (#Amount) of engineering hours, then PKS could work shoulder-to-shoulder with engineers at KPE's office. How much value will this add to our company?
- 12) What would it be if we can achieve the results we had in the many projects during the last two years where budget and schedule were met, and even more, if our PKS contractor partner can rely on high quality designs from KPE? What do you think about this?

Transition Questions

- 13) After seeing all the benefits of doing the Civil/Structural design in-house and more important, being able to meet the schedule, shouldn't we start working right away on the details of how to solve the needs for meeting schedules and saving money?
- 14) Would it be possible to schedule another meeting to discuss the details about what project we can help on right away? We will need to start our recruitment and training so the workforce will be ready for the next project!

12. Appendix B

The following template is to assist in identifying the buying team.

Buying Team Member	Team Member Playing this role	Level of Influence	Team Member's Perceived Needs and Expectations
Initiators	The Division Manager	High	Schedule impact translating into money and reputation loss; if done in-house PKS may be able to save money and create a stronger design-build team.
Users	Contractors in the Energy Group.	Low	Engineer does not understand schedule and cost. Contractor needs to keep it in line.
Influencers	Managers of PKS's Transportation and Industrial Group	Medium on Power Division, high on their own division	Not sure about outcome, if done by third party liabilities can be shared in a better way.
Purchasers	The Division Manager and Other Managers	Low in terms of amount of money spent, since they will save money for the company	Need to meet schedule, have better control of engineers in Design-build format
Deciders	The Division Manager and other Division Managers	High	Power Division manager is on board as long as we meet the needs; other managers would have to be convinced.
Gatekeepers	The Division Manager	Medium	Once the Division Manager agrees to KPE doing the

			Civil/Structural work, the Project Managers will follow.
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Table 4-Worksheet for identifying members and roles for the buying team